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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/823,638	03/30/2001	Ryou Nakagaki	16869P023300	6928

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EXAMINER

SHAPIRO, JEFFERY A

ART UNIT PAPER NUMBER

3653

DATE MAILED: 08/05/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/823,638

Applicant(s)

NAKAGAKI ET AL.

Examiner

Jeffrey A. Shapiro

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 11 July 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-11 and 23-32 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-11 and 23-32 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

**DETAILED ACTION**

***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-11 and 28-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stephan et al (US 6,338,001 B1). Stephan et al discloses the following.

As described in Claims 1, 6, 9, 11 and 30-32;

1. imaging an inspected object (204) (see col. 5, lines 10-16);
2. extracting an image of a defect candidate from an image obtained by said imaging step (see col. 5, lines 10-16);
3. classifying said extracted defect candidate image into a first category (at least one defect type) (see col. 5, lines 16-20, noting "defects are classed as to type and size");
4. classifying said extracted defect candidate into a second category (evaluation of defect criticality) (see col. 5, lines 20-27, noting that criticality is construed as a kill ratio);
5. displaying on a screen said extracted defect candidate image and information relating to said classification into said first category and information relating to said classification into said second category;

(See figure 4, noting that it would have been obvious for the image data to be presented along with the defect data and kill ratio data, for example, which describes it, otherwise, effective review of said defect by an engineer (see col. 4, lines 65-67 and col. 5, lines 1-10) would not be available, said review necessarily requiring a visual representation of the particular defect so that appropriate changes can be made to the process or design of the chip);

6. *said step of classifying said extracted defect candidate image into said second category is performed by comparing a circuit pattern area and a defect area, said circuit pattern area being obtained from a reference image and said defect area being obtained from said imaging step;*

(Regarding using a comparison image, note that it would have been obvious to one of ordinary skill in the art to use a comparison image from an ideal circuit pattern to compare to a defect area image. Otherwise, there is no way to determine the bounds of roundness, straightness, etc., of metal lines and structures created on the wafers, as described in Stephan et al at col. 1, lines 42-47. It is of the opinion of the Examiner that this aspect is a matter of common sense to one of ordinary skill in the art, in context to the discussion in Stephan et al. See also Chen et al (US 5,862,055), figure 3, step (304), incorporated by reference in Stephan et al. As a further example, see Gleason et al, at col. 2, lines 58-63 which

describes use of a reference image (21) for comparison with defect image (22).

Further regarding Claim 32, note that evaluating overlap areas between the defect area and the reference circuit area are considered to be obvious, and that comparison of the two area images without overlay are considered to be functional equivalents.

As described in Claims 2, 7, 10 and 23-25;

6. said imaging of said inspected object is performed by illuminating and scanning an electron beam focused on said inspected object and detecting, in synchronization with said scanning, secondary electrons generated from said inspected object by said illumination (note that it is inherent to provide an electron beam for scanning, said electron beam necessarily producing secondary electrons from the surface it is directed at—see Gleason et al, for example, at col. 2, lines 58-63);

As described in Claims 3, 4, 26 and 28;

7. said first category relates to defect criticality;
8. said second category relates to defect criticality;
9. said second category relates to defect type;
10. said first category relates to defect type;

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(Note that regardless of whether or not the criticality or the defect type is determined first, the process result is substantially the same as Applicants' process. Note also that the location of a particular defect is captured by the scanner, which is necessarily used for determining criticality, since criticality can be defined in terms of the location of the defect. See col. 1, lines 61-64.)

As described in Claims 5 and 8;

11. said defect type includes one or more of the following: particle defects, flaw defects, circuit pattern short defects, circuit pattern open defects and voltage contrast defects; (Note that an inspection system such as that of Steffan et al determines such defects, as one ordinarily skilled in the art would recognize them as well-known semiconductor circuit defects found in wafers during manufacturing. Note that these defects are considered to be functional equivalents of each other, at the very least. See also Nishimura et al, figure 3 and Kumagai et al, figure 9.)

As described in Claim 9;

12. said second category relating to predicted yield from said inspected object (316);

As described in Claim 29;

13. calculating third information relating to voltage contrast of the defect candidate; (Note that this is considered to be a functional equivalent of other dimensional defects, and are related to shorts circuits or connection

faults, as described in figure 3 of Nishimura et al. See also Jarvis et al (US 6,297,644), last four lines of abstract and figures 9a, 9b, 10a, 10b and 11, illustrating short circuit situations and col. 2, lines 66 and 67, col. 3, lines 1-9, and col. 7, lines 58-60, mentioning use of a scanning electron microscope (SEM) to perform such voltage contrast studies of defects. Note also that Stephan, at col. 2, lines 4-10, indicate that SEM is one of the pieces of equipment used for inspection of wafers.

### ***Response to Arguments***

3. Applicant's arguments filed 7/11/03 have been fully considered but they are not persuasive. Applicant asserts that using a kill ratio for each defect is not determining if a defect is a killer defect or not. This appears to the Examiner to be incorrect. The definition of a killer defect is stated in Applicant's specification at p.16, lines 28-31 and p.17, lines 1-4, which states that a killer defect is considered a killer defect if after measurement of a particular feature, that feature fits into a particular range of values. The prior art does this very step. In fact, it can be argued that in order to obtain the killer ratio, described in Applicant's specification at p.17. lines 5-8, it is necessary to obtain the individual defects of a certain type. These defects are each individually classified as defects because they do not fit into a tolerance band as to size, for example. See again, Stephan et al, col. 5, lines 10-29, noting that "type" and "size" of a defect are indicated as being used for classification of defects. Note also that Jarvis et al, at col. 3, lines 58-63 and at col. 5, lines 46-62, describes determining particle size distribution. In addition, it can be argued that using a kill ratio essentially classifies a

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defect as being either a killer defect or non-killer defect, by placing a numerical percentage indicator of the health of the die. See Stephan, at col. 5, lines 33-45.

As described above, Stephan et al also indicates use of an image (see above discussion and mention of imaging tools.) If there is no image obtained, then how is classification performed? There must be a way to place it into the system, otherwise, the review and automation classification tool/system (108) would not be able to yield adequate data to the system, so as to allow killer ratios to be determined. This is especially true for wafer die defects, which are on the order of angstroms in length or diameter, and can not be readily seen with the naked eye.

Stephan et al is not provided in a vacuum. The specification and claims are directed towards a system of classification which resides in a wafer die manufacturing environment. Therefore, certain aspects can be inferred as expedient or necessary for operation in such an environment. The system of Stephan et al, as described above, uses the automatic defect classification system. In addition, further aspects of the environment in which the system of Stephan operates are provided by the prior art examples cited above, which illustrate the state of the art in wafer die inspection for a wafer die manufacturing environment. All cited examples of prior art, above, are analogous to Stephan et al, since they all concern inspection of wafer die in a manufacturing environment. See also Kirsch et al (US 6,507,933 B1) which indicates human user entry of data is recognized as a readily used method, but that those ordinarily skilled in the art would recognize that this would result in sub-optimum data. See col. 6, lines 45-60, noting that Kirsch et al is also analogous to Stephan, since they



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both concern since they both concern inspection of wafer die in a manufacturing environment.

As Stephan et al appears to still read on Applicant's independent claims, as currently written, and reasonably broadly construed, the rejection is maintained.

Applicant's representative is encouraged to contact the Examiner should there be any questions regarding prosecution of this application.

***Conclusion***

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Kikuchi is cited as an example of a wafer inspection device.

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

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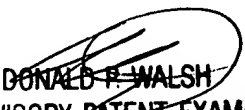
6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffrey A. Shapiro whose telephone number is (703)308-3423. The examiner can normally be reached on Monday-Friday, 9:00 AM-5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Donald P. Walsh can be reached on (703)306-4173. The fax phone numbers for the organization where this application or proceeding is assigned are (703)306-4195 for regular communications and (703)306-4195 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-1113.



Jeffrey A. Shapiro  
Patent Examiner,  
Art Unit 3653



DONALD P. WALSH  
SUPERVISORY PATENT EXAMINER  
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August 1, 2003